The BORDLINE® M15 DC static converter is a compact, rugged unit developed to feed induction motor, DC loads and charge the batteries of the tram.

**Characteristics**
- IGBT technology
- Compact and robust design
- Integrated sine filter
- Fed by 750 Vdc catenary (500 Vdc - 950 Vdc)
- Outputs: 380 Vac 50Hz 3Ph, 24 Vdc
- Natural convection cooling
- Installation on the roof

**System overview**
The BORDLINE® M15 DC converter is based on modern IGBT technology.

The system is composed by:
- n° 1 input filter for the catenary voltages (750 Vdc)
- n° 1 DC/AC inverter with adjustable output frequency up to 50Hz (380 Vac 50Hz 3Ph) to supply motor
- n° 1 DC/DC converter that turns catenary voltage (750 Vdc) into 24 Vdc to supply the batteries and other DC loads of the vehicle

**HV Input Filter (750 Vdc)**
The converter is powered by the catenary line through an Input Filter, with working range between 500 Vdc and 950 Vdc.

**3Ph inverter (750 Vdc/380 Vac 50Hz 3Ph)**
The three phase inverter, due to the installed sine-filter, generates a sine wave three phase voltage at the converter output. A V/F control is implemented to limit the inrush current when a heavy load is powered (e.g. compressors). The three phase inverter is galvanically insulated by a 50 Hz transformer. The nominal output power is 5 kVA with a 7,5 kVA peak up to 20 sec.

**Battery charger (750 Vdc/24 Vdc)**
It is configured in a isolated full bridge. This module generates a square wave for the output filter in order to generate a DC voltage (24 Vdc) to supply external DC loads and to charge the batteries. A control for compensation in temperature of batteries charging voltage is integrated.
Control and monitoring
The monitoring of converter and battery charger status is provided by lamps and dedicated I/O signals. Battery charger output can be monitored by two current 4 - 20 mA signals (output voltage and output current).

Cooling system
The converter is cooled by natural convection.

Mechanical design
The metal structure is stainless steel with IP65 protection and it has been designed for a roof mounting. The converter has been designed for a reliable outdoor application, for an easy diagnostic status when installed in the vehicle and an easy maintenance in the lab.

Application example
BORDLINE® M15 DC_750V is mounted in trams produced by Durmazlar and running in Bursa (Turkey). ABB converter has been designed for a new tramway design project.

Diagnostics and service
The service-friendly modular design with highly standardized components ensures high reliability, excellent spare parts availability, and optimized life-cycle costs.

Technical data
BORDLINE® M15 DC_750V

<table>
<thead>
<tr>
<th>Input voltage</th>
<th>750 Vdc (500 Vdc - 950 Vdc)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output voltages</td>
<td>380 Vac 50Hz 3 Ph 24 Vdc</td>
</tr>
<tr>
<td>Output power</td>
<td>5 kVA + 10 kW</td>
</tr>
<tr>
<td>Protection degree</td>
<td>IP65</td>
</tr>
<tr>
<td>Dimensions (L x W x H)</td>
<td>700 x 650 x 480 mm</td>
</tr>
<tr>
<td>Environmental conditions</td>
<td>-25°C ÷ +55°C</td>
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<tr>
<td>Weight</td>
<td>240 kg</td>
</tr>
</tbody>
</table>

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